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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 09/670,000 | 09/25/2000 | James M. Holden | M-9455 US | 3656 |

34036 7590 07/27/2004

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| EXAMINER |
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KAO, CHIH CHENG G

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| ART UNIT | PAPER NUMBER |
|----------|--------------|

2882

DATE MAILED: 07/27/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

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|------------------------------|--|--------------------------------------|--|
| Office Action Summary | Application No. 09/670,000 | Applicant(s) HOLDEN ET AL. | |
| | Examiner Chih-Cheng Glen Kao | Art Unit 2882 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 June 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 3-16, 27 and 28 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 3-16, 27 and 28 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 16 June 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Drawings

1. The drawings were received on June 16, 2004. These drawings are acceptable.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 3, 5, 9, 10, 13, and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rosencwaig et al. (US Patent 5596406) in view of Reiley (US Patent 5519493) and Scheiner et al. (US Patent 6100985).
3. Regarding claims 3 and 13, Rosencwaig et al. discloses an apparatus and method comprising a radiation source emitting broadband radiation (Fig. 2, #32), a rotating polarizing element with radiation passing through the polarizing element toward a sample (Fig. 2, #122), said radiation being normally incident on and reflected off said sample (Fig. 2), said reflected radiation passing through a rotating polarizing element (Fig. 2, #132), at least one of the polarizing element and sample being rotatable to produce relative rotation (Fig. 2, #122), and a spectrograph that detects the intensity at a plurality of polarization orientations (Fig. 2, #64).

However, Rosencwaig et al. does not disclose reflected radiation passing through the polarizing element, a computer system with at least one computer and program to extract spectral information, constructing an optical model, calculating spectral information for the optical model, and curve fitting the calculated and extracted spectral information to determine one or more parameters of a diffracting structure on a sample.

Reiley teaches reflected radiation passing through the polarizing element (Fig. 1, #10, and Abstract). Scheiner et al. teaches a computer system with at least one computer and program (Fig. 2, #20) for extracting spectral information (Fig. 5A, #54), constructing an optical model (col. 11, lines 54-55), calculating spectral information for the optical model (Fig. 5A, #56), and curve fitting the calculated and extracted spectral information to determine one or more parameters of a diffracting structure on a sample (Fig. 5A, #58, 60, and 62).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to modify the apparatus of Rosencwaig et al. with the polarizing element of Reiley, since one would be motivated to incorporate it to determine polarization properties more quickly, accurately, and reliably (Abstract) as shown by Reiley.

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to modify the apparatus of Rosencwaig et al. with the computer program for analysis of Scheiner et al., since one would be motivated to incorporate it for providing a system that enables the relative small amount of information representative of the structure's conditions to be obtained and successfully processed for even more complicated structures (col. 2, lines 34-38) as shown by Scheiner et al.

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4. Regarding claim 5, Rosencwaig et al. as modified above suggests an apparatus as recited above.

However, Rosencwaig et al. does not disclose curve fitting comprising comparing extracted and calculated spectral information, adjusting at least one variable parameter of the model, recalculating spectral information for the model, comparing the extracted information and recalculated spectral information, and repeatedly adjusting the at least one parameter, recalculating spectral information, and comparing the extracted and recalculated information until an acceptable fit is achieved.

Scheiner et al. further teaches curve fitting comprising comparing extracted and calculated spectral information (Fig. 5A, #58), adjusting at least one variable parameter of the model, recalculating spectral information for the model (Fig. 5A, #60), comparing the extracted information and recalculated spectral information (Fig. 5A, #58), and repeatedly adjusting the at least one parameter, recalculating spectral information, and comparing the extracted and recalculated information until an acceptable fit is achieved (Fig. 5A, #64).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to further modify the apparatus of Rosencwaig et al. with the computer program for analysis of Scheiner et al., since one would be motivated to incorporate it for providing a system that enables the relative small amount of information representative of the structure's conditions to be obtained and successfully processed for even more complicated structures (col. 2, lines 34-38) as shown by Scheiner et al.

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5. Regarding claim 9, Rosencwaig further discloses a dispersing element and an array of detector pixels (col. 7, lines 38-44).

6. Regarding claims 10 and 15, Rosencwaig further discloses a rotatable polarizing element (Fig. 1, #122).

7. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Rosencwaig et al. in view of Reiley and Scheiner et al. as applied to claim 3 above, and further in view of Solomon et al. (US Patent 5900633).

Rosencwaig et al. as modified above suggests an apparatus as recited above.

However, Rosencwaig et al. does not disclose curve fitting using non-linear regression.

Solomon et al. teaches curve fitting using non-linear regression (col. 8, line 64, to col. 9, line 6).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to modify the apparatus of Rosencwaig et al. as modified above with the non-linear regression of Solomon et al., since one would be motivated to incorporate it to better find a best fit between the extracted and simulated parameters iteratively and automatically (col. 8, line 64, to col. 9, line 6) as shown by Solomon et al.

8. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Rosencwaig et al. in view of Reiley and Scheiner et al. as applied to claim 3 above, and further in view of Xu et al. (US Patent 5900633).

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Rosencwaig et al. as modified above suggests an apparatus as recited above.

However, Rosencwaig et al. does not disclose rigorous coupled-wave analysis for modeling.

Xu et al. teaches rigorous coupled-wave analysis for modeling (col. 7, lines 40-51).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to modify the apparatus of Rosencwaig et al. as modified above with rigorous coupled-wave analysis of Xu et al., since one would be motivated to incorporate it to reduce computation time (col. 7, line 20, to col. 8, line 12) as implied from Xu et al.

9. Claims 7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rosencwaig et al. in view of Reiley, Scheiner et al., and Motulsky (Analyzing Data with GraphPad Prism).

For purposes of being concise, Rosencwaig et al. as modified above suggests an apparatus as recited above.

However, Rosencwaig et al. does not disclose curve fitting with $R(\Theta) = A \cos^4(\phi - \Theta) + B \sin^4(\phi - \Theta) + C \cos^2(\phi - \Theta) \sin^2(\phi - \Theta)$, which is sum-of-squares with variables in non-linear regression.

Motulsky teaches curve fitting with sum-of-squares and variables in non-linear regression (Pages 164-165).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to modify the apparatus of Rosencwaig et al. as modified above with the

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curve fitting of Motulsky, since one would be motivated to incorporate it for better interpreting information (Page 157) as implied from Motulsky.

10. Claims 11, 12, and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rosencwaig et al. in view of Reiley, Scheiner et al., and Shibata et al. (US Patent 6690469).

For purposes of being concise, Rosencwaig et al. as modified above suggests an apparatus as recited above.

However, Rosencwaig et al. does not disclose a rotating sample stage.

Shibata et al. teaches a rotating sample stage (Fig. 3, #3-6).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to modify the apparatus of Rosencwaig et al. as modified above with the sample stage of Shibata et al., since one would be motivated to incorporate it for more maneuverability (Fig. 3, #3-6) as implied from Shibata et al.

11. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Rosencwaig et al. in view of Reiley and Scheiner et al. as applied to claim 13 above, and further in view of Xu et al. (US Patent 6483580).

Rosencwaig et al. as modified above suggests a method as recited above.

However, Rosencwaig et al. does not disclose a reference database.

Xu et al. teaches a reference database (col. 3, lines 29-30).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to modify the method of Rosencwaig et al. as modified above with the

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reference database of Xu et al., since one would be motivated to incorporate it for better providing a means for comparing detected intensities to a database to determine one or more parameters of the object of inspection (col. 3, lines 26-40) as shown by Xu et al.

12. Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over Rosencwaig et al. in view of Shibata et al.

For purposes of being concise, Rosencwaig et al. discloses an apparatus as recited above.

However, Rosencwaig et al. does not disclose a rotating sample stage.

Shibata et al. teaches a rotating sample stage (Fig. 3, #3-6).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to modify the apparatus of Rosencwaig et al. with the sample stage of Shibata et al., since one would be motivated to incorporate it for more maneuverability (Fig. 3, #3-6) as implied from Shibata et al.

13. Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Rosencwaig et al. in view of Shibata et al. as applied to claim 28 above, and further in view of Reiley.

Rosencwaig et al. as modified above suggests an apparatus as recited above.

However, Rosencwaig et al. does not disclose reflected radiation passing through the polarizing element.

Reiley teaches reflected radiation passing through the polarizing element (Fig. 1, #10, and Abstract).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to modify the apparatus of Rosencwaig et al. as modified above with the polarizing element of Reiley, since one would be motivated to incorporate it to determine polarization properties more quickly, accurately, and reliably (Abstract) as shown by Reiley.

Response to Amendment

14. The declaration filed on June 16, 2004, under 37 CFR 1.131 is sufficient to overcome the Wack et al. (US Patent 6673637) reference.

Response to Arguments

15. Objections to the claims in the Office Action mailed March 17, 2004, have been withdrawn in light of the Amendment filed June 16, 2004.

16. Applicant's arguments with respect to claims 3-16, 27, and 28 have been considered but are moot in view of the new ground(s) of rejection.

Regarding Reiley, Applicant argues that Reiley teaches the use of a separate and distinct polarization state generator and analyzer and fails to disclose or suggest a single polarizing element. The Examiner disagrees for the following reason. The radiation passes through the polarization state generator twice, thus passing through the same polarization element. Therefore, Reiley does disclose or suggest such an element.

Regarding Motulsky, Applicant argues that Motulsky does not disclose or suggest curve fitting with $R(\Theta) = A \cos^4(\phi - \Theta) + B \sin^4(\phi - \Theta) + C \cos^2(\phi - \Theta) \sin^2(\phi - \Theta)$. Although the

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Examiner agrees that Motulsky does not disclose this, Motulsky nevertheless suggests it by its teaching of using non-linear regression with sum-of-squares. Therefore, there is at least a suggestion of curve fitting with $R(\Theta) = A \cos^4(\phi - \Theta) + B \sin^4(\phi - \Theta) + C \cos^2(\phi - \Theta) \sin^2(\phi - \Theta)$ in Motulsky.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chih-Cheng Glen Kao whose telephone number is (571) 272-2492. The examiner can normally be reached on M - F (9 am to 5 pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ed Glick can be reached on (571) 272-2490. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


gk
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